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We've worried about overpopulation for centuries. And we've always been wrong.

Earth's population trends, explained.

By Kelsey Piper | Aug 20, 2019, 8:10am EDT

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That sounds like the route to an overpopulation apocalypse, right? To many midcentury demographers, futurists, and science fiction writers, it certainly predicted one

demographers, futurists, and science fiction writers, it certainly predicted one.** Extending the timeline, they saw a nightmarish future ahead for humanity: human civilizations constantly on the brink of starvation, desperately crowded under horrendous conditions, draconian population control laws imposed worldwide.

Stanford biologist Paul Ehrlich wrote in his best-selling 1968 book *The Population Bomb*, "In the 1970's, hundreds of millions of people will starve to death" because of overpopulation. (Later editions modified the sentence to read "In the 1980's.")

None of that ever came to pass.

The world we live in now, despite approaching a population of nearly 8 billion, looks almost nothing like the one doomsayers were anticipating. Starting in the 19th century in Britain and reaching most of the world by the end of the 20th century, birthrates plummeted — mostly because of women's education and access to contraception, not draconian population laws.

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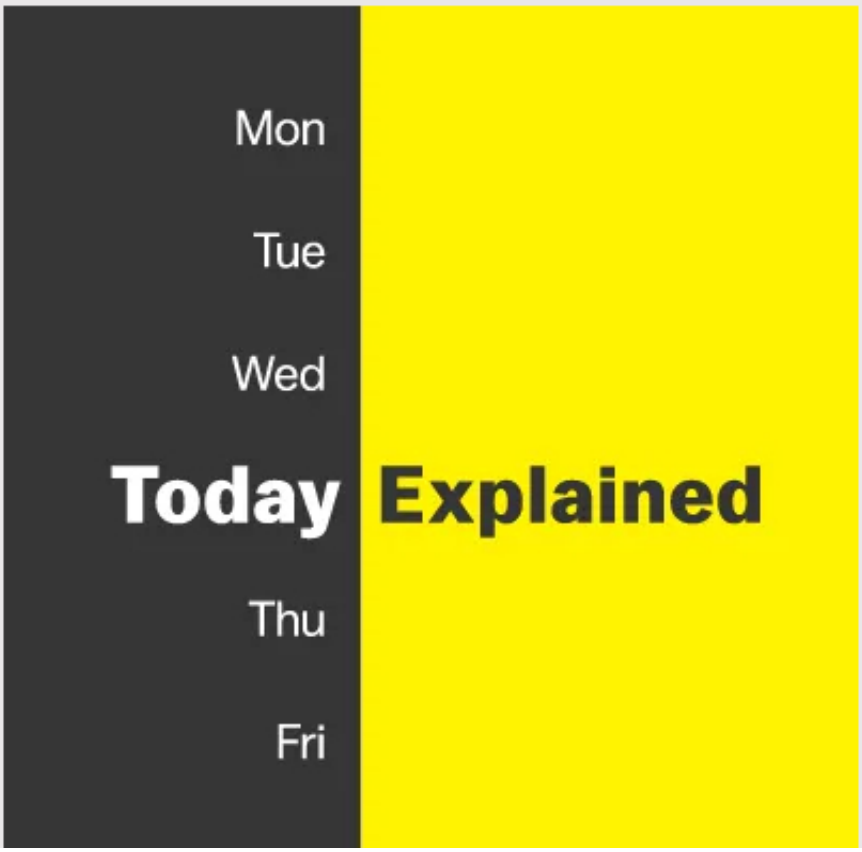

In wealthy societies where women have opportunities outside the home, the average family size is small; in fact, it's below replacement level (that is, on average, each set of two parents has fewer than two children, so the population shrinks over time). Called the demographic transition, it is one of the most important phenomena for understanding trends in global development.

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There's still significant debate among population researchers about the extent of the sea change in population trends. Researchers disagree on whether global populations are currently on track to start declining by midcentury. There's also disagreement on what the ideal global population figure would be, or whether it's morally acceptable to aim for such a figure.

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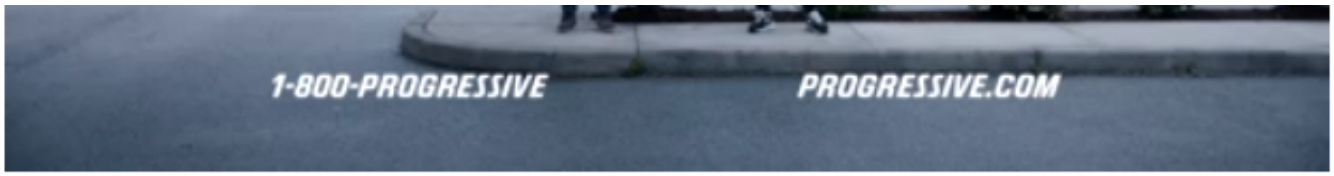


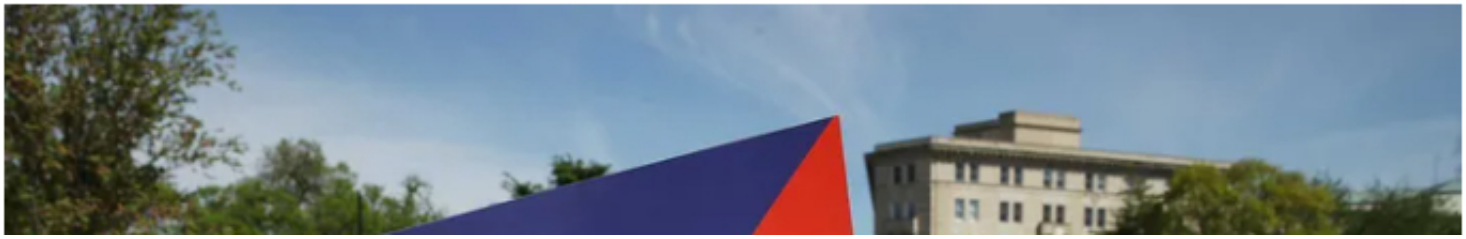
While academic research seeks to nail down these questions, it's important to be clear what is consensus among researchers. All around the world, birthrates are declining rapidly. Global population growth has been slowing since the 1960s, and global population will almost certainly start to decline. The world is absolutely not, as is **sometimes claimed**, on track to have 14 billion people by 2100.

Our projections around population are used to make global health and development policy. They're critical for planning, especially about climate change. Fears of overpopulation sometimes turn into hostility to immigrants, those who choose to have large families, and countries in an earlier stage of their population transition. Having an informed conversation about population is crucial if we are to get humanity's future right.

How we figure out population trends

There are about 7.7 billion people alive today. But that number's not as certain as you might think.

To understand why, you just have to think about the US census. The federal government is mandated by the Constitution to conduct a count of its population every 10 years. It is a big, industrialized country with modern technology and lots of resources. In 2010, it is estimated that our count of our nation of 300 million-plus was off by **only about 36,000 people — or only 0.01 percent**. That's pretty good (if researchers' estimate of the errors is reliable)! But that decent overall count masks some bigger errors: The same analysis estimates the black population was **undercounted by 2 percent**.



Protesters gather outside the US Supreme Court as the Court hears oral arguments about a question about citizenship included by the Trump administration in the proposed 2020 census, on April 23, 2019. | Win McNamee/Getty Images

In many parts of the world, population data is much less reliable. Countries can have incentives both to **overcount** (in regions vying to demonstrate increased need for aid, say) and **undercount** their populations (perhaps to disfavor a disliked minority group). Even without any efforts to manipulate the numbers, it's expensive and challenging to accurately estimate populations.

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If estimating populations is hard, estimating population trends is much harder. The demographers who estimated a ruinous, extremely fast growth trajectory were wrong, but how could they have known that the trend they were observing was about to reverse?

Today, it's still challenging to confidently estimate population sizes. But some organizations and institutions have done surprisingly well.

The United Nations publishes an estimate annually of the most likely population trend and then "high" and "low" fertility scenarios. These reports have turned out to be surprisingly accurate.

Since the UN has been making population projections since 1950, and since it publishes revisions and corrections to those projections over time, we can compare its initial estimates to the revisions and corrections. Researcher Nico Keilman did that, and found that the UN has an **impressively accurate track record** at population predictions. Their estimates of world population by 1990, published in 1950, were off by about 12 percent.

They quickly got better: By 1960, those estimates were off by only about 2 percent. Since then, the UN has pegged global population growth rates pretty precisely. Here's a graph of real population growth over time, compared to population growth as the UN projected it:

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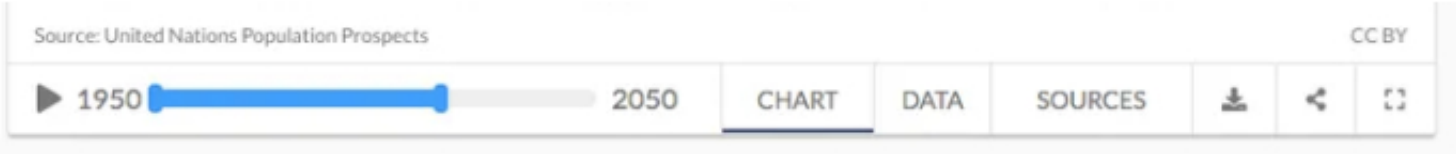

Our World In Data

So up to the present day, the UN has been highly reliable in predicting global population trends. Its prediction now is that the world population will continue to increase until 2100, when it will peak at 11.2 billion and then start declining.

Some experts don't buy the UN's estimates

Nonetheless, they have their critics. Other analysts have argued that fertility will in fact fall more dramatically than the UN estimates even in its "low-fertility scenarios." One such critic is Norwegian academic **Jorgan Randers**, who studies climate strategy. "The world population will never reach nine billion people," he **has claimed**. "It will peak at 8 billion in 2040, and then decline."

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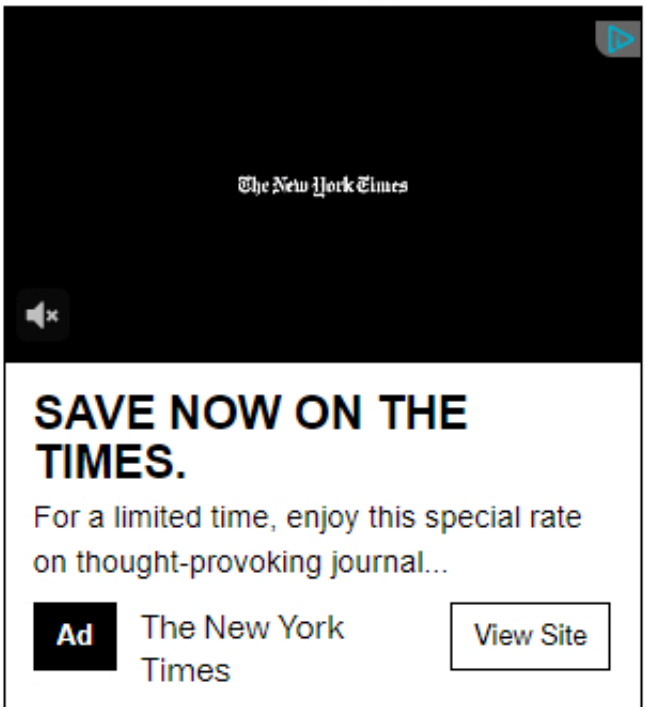
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Demographers at Vienna's **International Institute for Applied Systems Analysis** agree: They've **estimated the population will stabilize by midcentury and then decline**. These models expect fertility in low-income countries to fall faster than the UN projects it will.

Some of the differences are simply methodological. How the fastest-growing countries in the world are modeled has a huge impact on how global population models come out overall, so small differences in expectations in those countries can significantly shift overall results.

But much of the difference in projections may be rooted in disagreement over another question: how many people the world can handle. Adherents to lower-population models often call the UN projections "**apocalyptic**" — fearing that they'd make climate change impossible to manage. Demographer Wolfram Lutz has characterized the UN's model as the **"population explosion"** model (even though it projects a leveling off and declining population). Many of them have turned away from what they perceive as excessively "pessimistic" models toward ones that project a much faster-declining human population.

The challenges the pessimists anticipate aren't imaginary. With our current technology, of course, we don't know how to provide 11 billion people a good standard of living sustainably. But technology — including green and sustainable technology — has been rapidly improving for a long time. The year 2100 is more than 80 years from now, and almost all the technology that we have today to make civilization sustainable sounded like wild science fiction 80 years ago.

A global population peaking at 11 billion need not be an apocalypse or cause for pessimism, but it does pose challenges that we'll need to rise to.

While the UN deserves a lot of credit for how accurate they've been so far, past performance is obviously no guarantee of future accuracy. There's room for their estimates to be importantly wrong in the future — in either direction.

It's fairly straightforward to accurately predict the population in 20 years just by assuming that existing trends will continue. It's much harder to predict sea changes in

habits around the world. If, for example, climate change drives currently developed countries back into poverty and drives their birthrates back up, the estimates are poorly equipped to account for that. On the other hand, if more reliable contraceptives are developed and virtually end unintended pregnancies the world over, birthrates could fall much faster than predicted.

Nonetheless, this disagreement obscures a lot of agreement. Randers might call the UN estimates "apocalyptic," but they're incredibly optimistic compared to estimates at midcentury. Everyone now agrees that without any totalitarian or coercive measures, populations will start declining; the big disagreement is simply when.

It was not at all obvious that the world would turn out this way, and it's tremendously significant that it has. It implies both good things — that coercive population controls will never be necessary — and concerning ones, like that societies will age and have a shrinking workforce. But on the whole, we are much better positioned for sustainable growth than it looked in 1950, and the fall in rich-country birthrates is why.

Demographic transition, explained

The big thing we know now about population that was unclear in the mid-20th century is something called the "demographic transition." In its simplest form, it's the principle that when societies get wealthy and child mortality falls, people tend to start having less children.

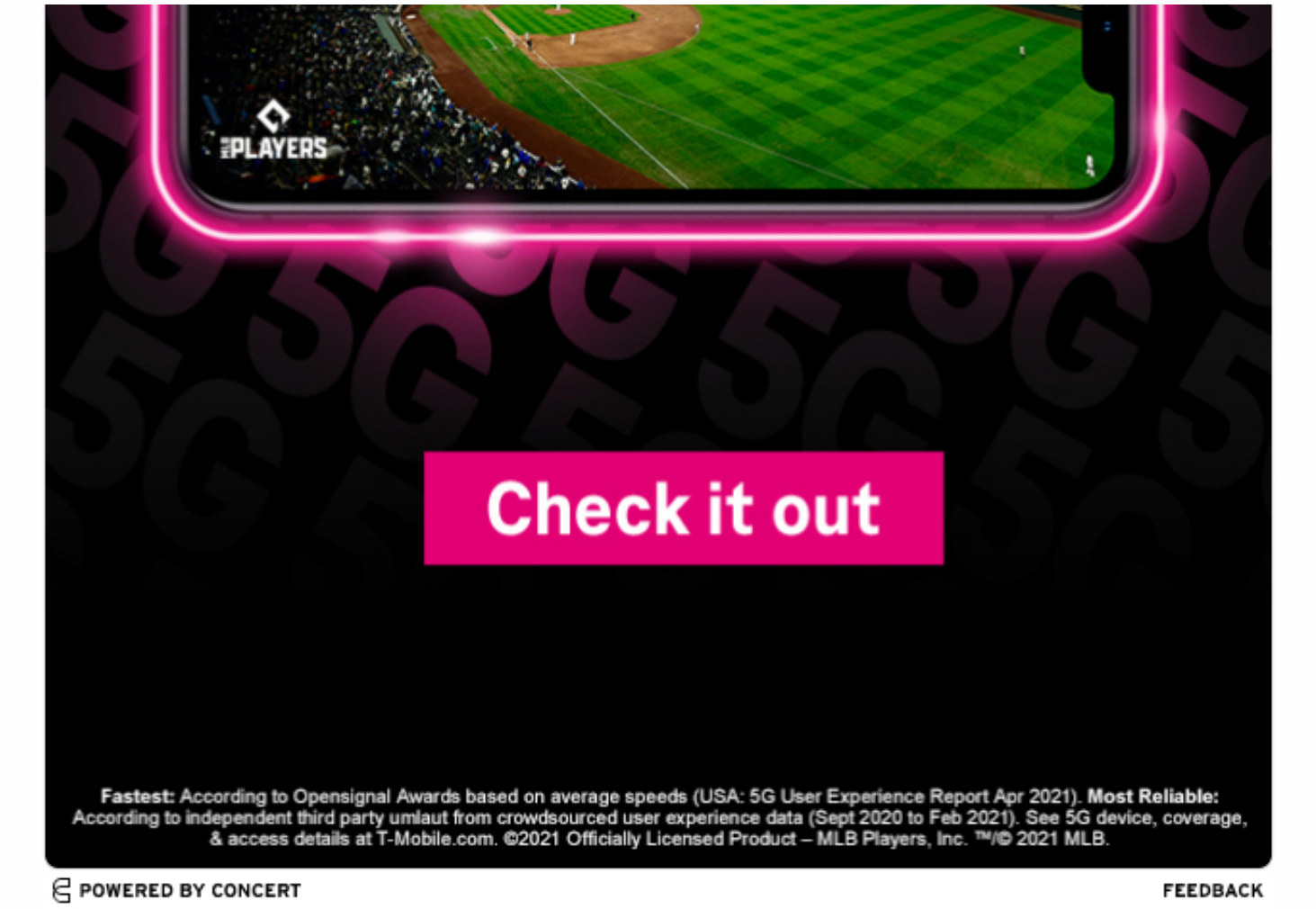
The connection between societies growing wealthier and people desiring smaller families is pretty straightforward. In richer societies, people do not need their kids to do labor and support the family, and they typically invest money and other resources in

their kids, to give them the best shot possible at a decent life.

The connection between drops in child mortality and smaller desired family sizes is less obvious. Indeed, at first, when child mortality falls, the population shoots up, as people are still having lots of kids, but more of them survive to adulthood.

That produces a rapid increase in population. That was the state of the world in the 1960s, and some parts of the world are still in that state now. But then, overall growth rates started to fall.

Let's pull back here and get into the weeds a bit. Demographers think of this process as occurring in five stages. First, birthrates are high but so are death rates, and the population is low but stable (when child mortality is high, people have lots of children to reduce uncertainty). Then, in the second stage, technology helps more kids survive to adulthood. Birthrates remain high, and the population grows rapidly: for one or two generations.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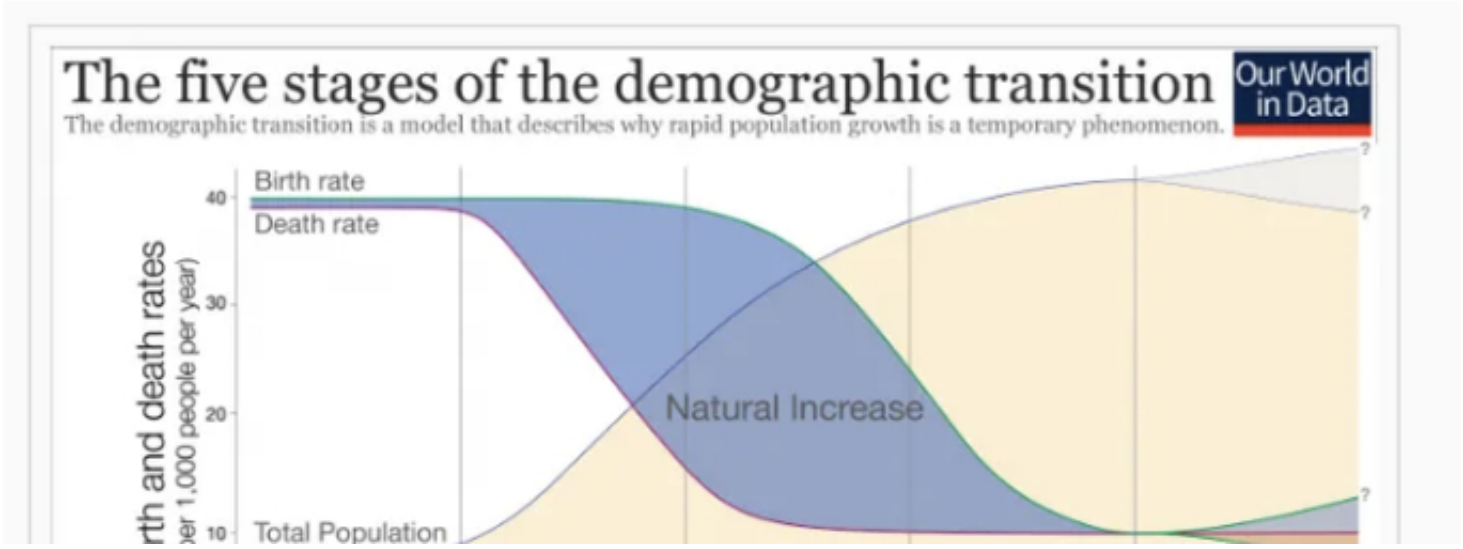
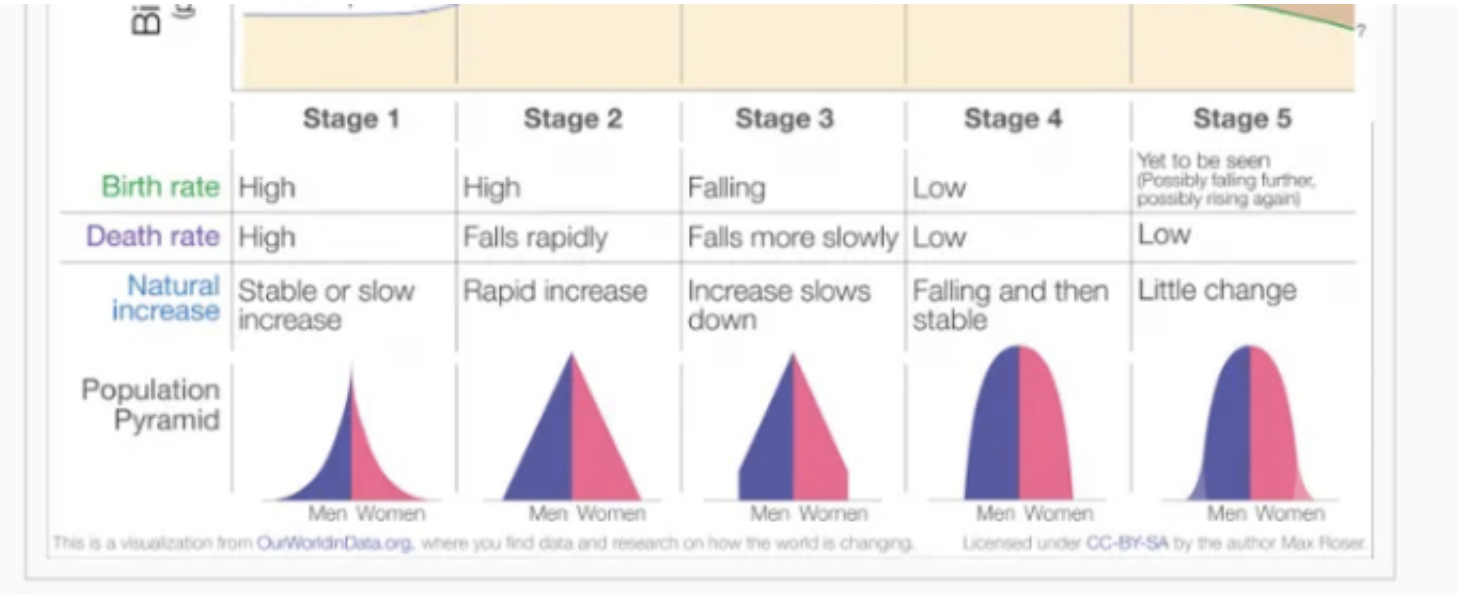
In the third stage, birthrates start to decline, driven by increased certainty about children's survival, women's rights, the dynamics of rich economies (where children are no longer an economic asset), and other factors. In the fourth stage, birthrates fall and the population stabilizes. It's a little unclear where we'll go from there (in the fifth stage): Populations might shrink due to below-replacement reproduction, or stabilize, or slowly grow.





Our World In Data, chart explaining the demographic transition

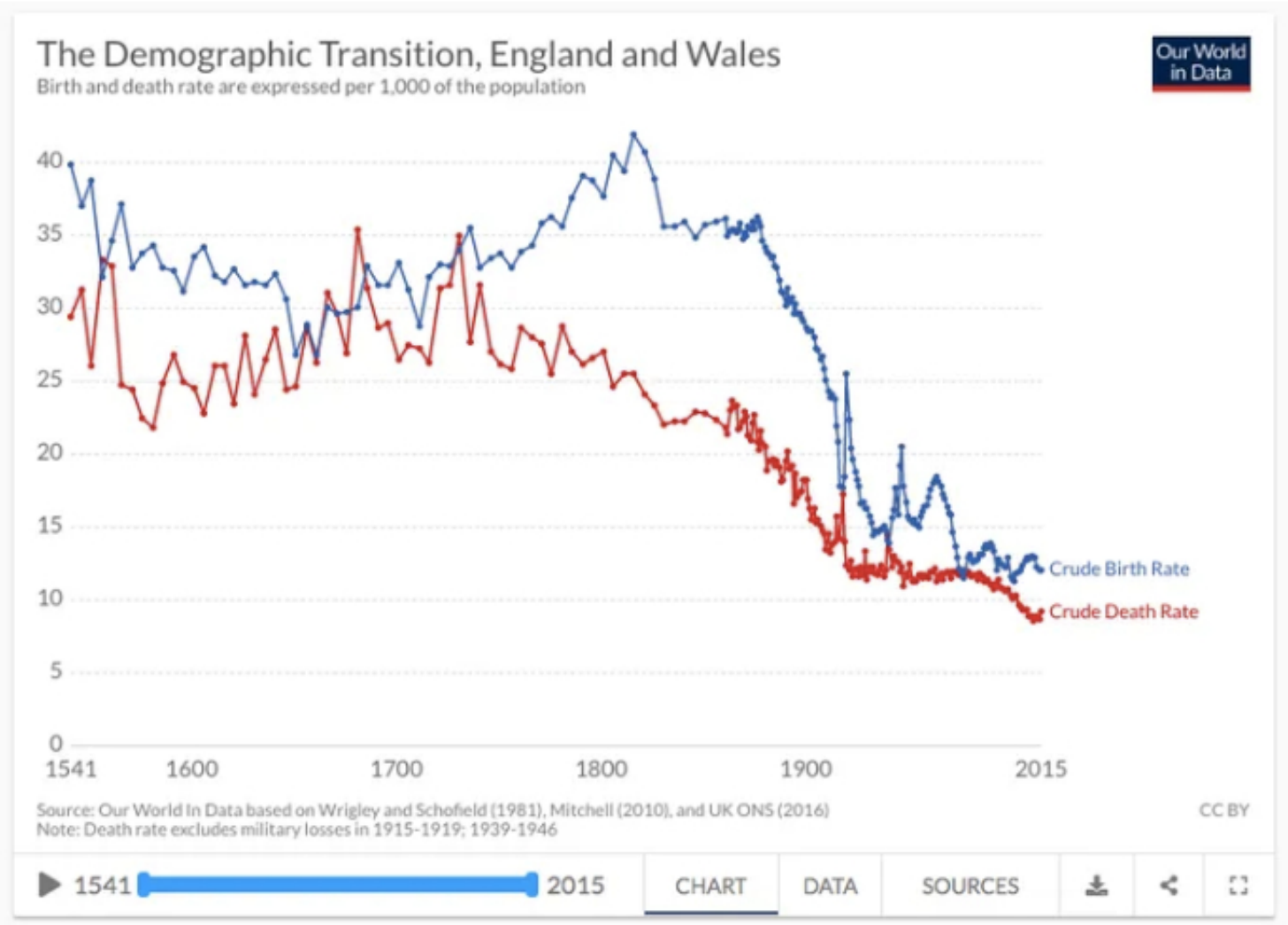
What does this demographic transition look like in action? In the US in 1900, the **average woman had 3.85 children**, and 0.89 children died before age 5 (the child mortality rate was 20 percent), leaving three surviving children on average. Today, the average woman has **1.9 children**, with an 0.7 percent child mortality rate.

People used to think that ending child mortality would lead to a dramatic swell in global populations, and it does, in Stage 2 of the above chart, where death rates fall and birthrates remain high. But then in every country yet studied, birthrates eventually end up falling too.

Some of the best research into the demographic transition was published in 1989 by British researchers Anthony Wrigley and Roger Schofield. As the first country to have the Industrial Revolution, Britain was the first to have the demographic transition

the Industrial Revolution, Britain was the first to have the demographic transition. Thanks to the state church, Britain also had unusually good birth and death records.

Here's how the demographic transition looked in Britain:



From Our World In Data, the progress of the demographic transition in England and Wales.

Today, most developed countries have joined Britain on the right end of that graph, with low birthrates and low death rates. Other countries, like Niger and Mali, are still in the middle stage, where death rates are falling but birthrates haven't yet followed suit.

That adds up to an overall global trend of a population that is still increasing, but it is increasing more slowly than ever.

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It's a reality that hasn't quite penetrated public consciousness yet. Public conversations are often still consumed by fear that the population is spiraling beyond what the world can support.

The popular 2013 environmentalist book ***Ten Billion*** reports still-growing population numbers without discussing the underlying trends towards leveling off and then falling, and concludes, **"Every which way you look at it, a planet of 10 billion looks like a nightmare."** Widely published excerpts don't mention that the population is expected to start falling again either before or shortly after that "nightmare" milestone is **rights, no matter what?"** without mentioning that populations are expected to decline on their own, no coercion required.

It's a fear that sometimes has racial and xenophobic components: European white nationalists spread panic over declining white birthrates, while others express fears that poor populations, still growing, will crowd out rich ones. But birthrates are declining in poor countries, too, and look likely to continue to do so as they rapidly get richer. The trend that reached Europe first has since swept the rest of the world and shows no signs of stopping.

Calls to have **few or no children to fight climate change are common**, with prominent figures such as **Miley Cyrus** and **Prince Harry** endorsing them. The underlying assumption is often that we're on a runaway path to an exploding population. This misses a couple of key facts about population trends: First, the population will decline even if everyone who wants children has them.

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Second, opposing children is not a good way to fight climate change. As **Lyman Stone** wrote for Vox, big changes in how the developed world produces power are what's needed, and they matter dramatically more than population does. "Lowering US carbon intensity by about a third, to around the level of manufacturing-superpower Germany today, has a bigger effect than preventing 100 million Americans from existing," **Stone argued**.

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In other words, if we don't transition to better energy sources, we're doomed no matter how much we shrink our numbers, and if we do, we could actually sustain a significantly increased population.

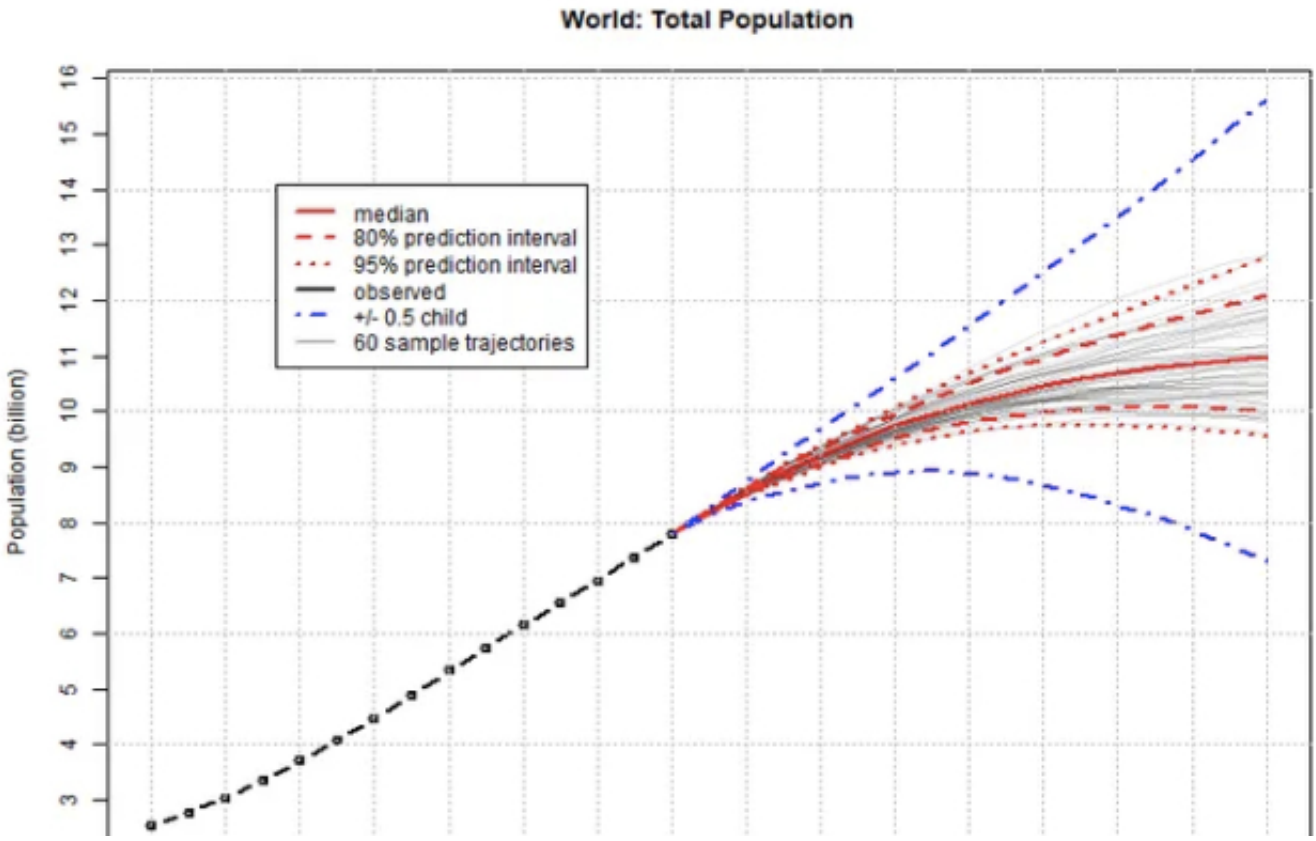
What we think we know about population growth in the upcoming century

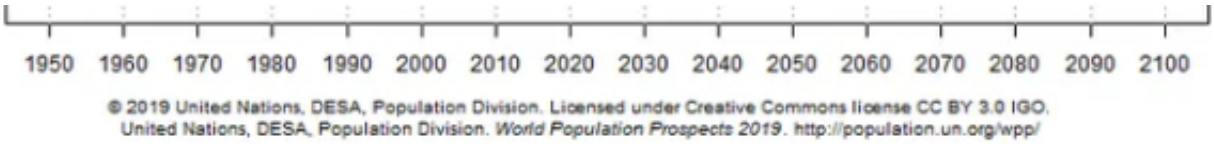
There's a lot of agreement between the UN and its critics when it comes to population forecasts. Both sides agree that fertility rates fall as countries get richer, and that even the poorest countries in the world are rapidly getting richer. Both agree that population will peak, and then start to decline.

Both agree that we're not yet at the peak, but that the Earth's population will never again double, barring some dramatic technological or cultural shift that fundamentally changes how humans live. Under a wide range of estimates, birthrates will remain below replacement in rich countries, and poor countries will continue to get wealthier and to have fertility patterns that are more similar to those in wealthy countries.

As for their disagreements, they'll be resolved by the real-world data soon enough. For the UN's mainline estimate of how these trends will continue into the future, it assumes that these trends will continue at approximately the pace they've kept through the past several decades.

Here is the 2019 UN population forecast:





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The red lines reflect the UN's predicted trajectories; the UN is 95 percent confident that population will fall between the two dotted red lines. The lower side of 95 percent confidence interval has global population peaking in 2070 and falling slowly from there; the upper side has population approaching 13 billion and still increasing in 2100.

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The blue lines reflect the UN's projection of how population numbers would shake out if birthrates were 0.5 children higher or lower. The total global birthrate is 2.4 births per woman today. The lower blue line is closest to the trajectory argued for by the European researchers who consider the UN pessimistic; it shows population peaking around 2050 and falling from there.

Under the mainline UN estimates, global population will grow for the rest of this century, but slowly, and this will be the last century with a growing population. The UN has an impressive track record in this area, but some European analysis groups think that the UN is estimating fertility that's higher than realistic, and that population numbers will fall much sooner. It should be clear by 2030 who is correct.

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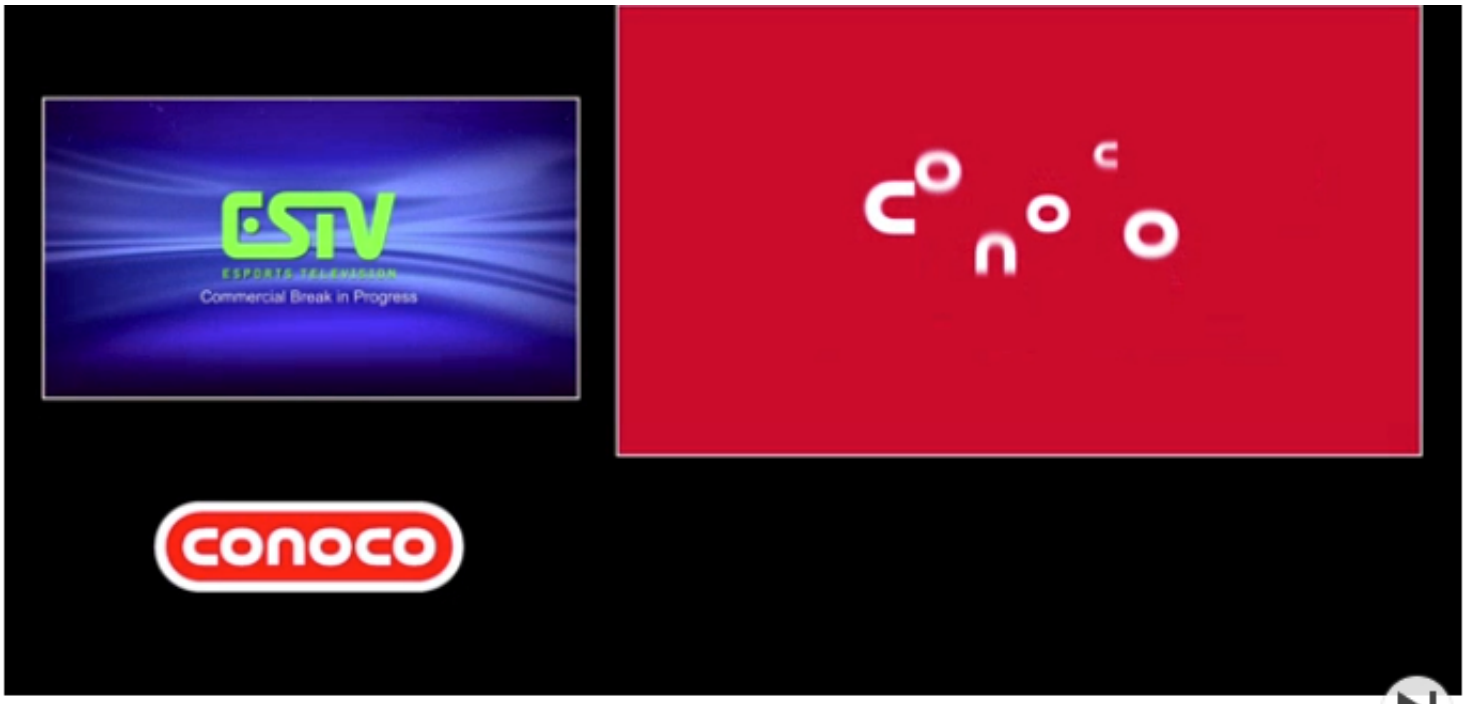

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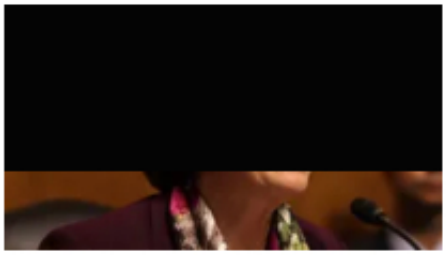

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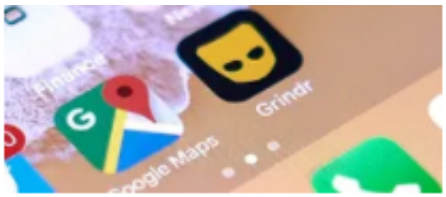

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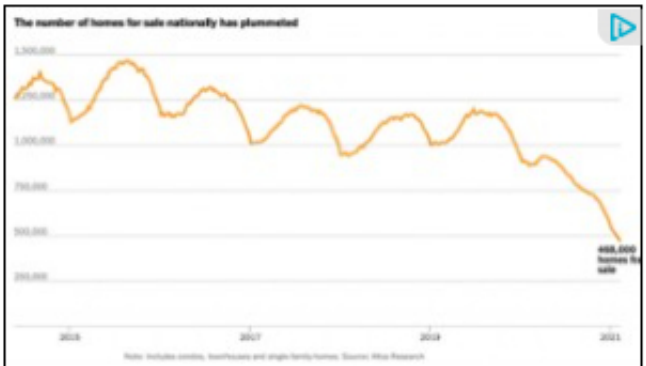

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